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Long term effects of forest fires to soil C content and soil CO_2 efflux in hemiboreal Scots pine forests of Estonia.

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Fire is the primary process which organizes the physical and biological attributes of the boreal biome and influences energy flows and biogeochemical cycles, particularly the carbon (C) cycle. Especially the soil organic matter pool in boreal forests is an important C storage with a long C turnover time, but fire frequencies that are expected to increase with changing climate, can change that.

We compared the initial recovery of C pools and CO_2 efflux following fire disturbances in Scots pine (*Pinus sylvesteris* L.) stands with different time since fire. The study areas are located in hemiboreal vegetation zone, in northwestern Estonia, in Vihterpalu. Six areas (with extensive fires 200 ha and more) were chosen for study: fire in a year 1837, 1940, 1951, 1982, 1997, and 2008. In all areas we are dealing with stand replacing fires where all (or almost all) of the stand was destroyed by fire. On every area we established three permanent sample plots. Soil respiration was measured manually from all sample plots (measuring interval of two - three weeks). Manual chamber measurements are performed on 5 collars (north – south orientated and the distance between collars is 5 m) at each sample plot from May till November 2015. To characterize the soil C and N content and fine root biomass at the sites, 5 soil cores (0.5 m long and 0.05 m in diameter) were taken from each sample plot.

Our results show that forest fire has a substantial effect on the C content in the top soil layer, but not in the humus layer and in mineral soil layers. Soil respiration showed similar chronological response to the time since the forest fire indicating that substantial proportion of the respiration was originating from the very top of the soil. Soil respiration values were lowest on the area where the fire was in a year 2008 and the respiration values followed also seasonal pattern being highest in August and lowest in May and November. The CO_2 effluxes were lowest on newly burned area through the entire growing season. There was positive correlation between soil temperature and soil respiration values in our study areas.